# *INSTRUCTION MANUAL*

FOR

*ELECTRONIC INSTRUMENTATION FOR INDUSTRY*

CALIBRATION STANDARDS CORPORATION *a subsidiary of* **ROYAL INDUSTRIES, INC.**

# AC-DC VOLTMETER

## MODEL AC-200AR

INSTRUMENT
CENTER

SERIAL 1323

CALIBRATION STANDARDS CORPORATION

A subsidiary of Royal Industries, Inc

1031 Westminster Avenue

Alhambra, California

CUmberland 3-8156

CS4-501

Issued

## IMPORTANT

FOR OPTIMUM RESULTS READ THIS INSTRUCTION MANUAL CAREFULLY

The instrument covered in this manual is of an advanced design in the field of transistorized precision test equipment.

You will find this instrument has many distinct advantages over the operating characteristics found in equipment costing many times as much.

Since this instrument incorporates advanced engineering techniques and design, it is imperative that you become familiar with the proper operating procedure.

One of the superior features found in this instrument is the elimination of the usual electronic zero controls. The meter need only be zeroed by the mechanical adjustment screw on its case while the instrument is in operation.

The meter zeroed in this manner, may show an offset of the needle from zero when the instrument is turned off. This is normal. (The mechanical zero of the meter deviates slightly from the instrument's electrical zero.)

## OPERATING INSTRUCTIONS

### DC Mode

1. The line cord should be plugged into a 117 volt 60 cycle power source.
2. Turn the null selector to the VTVM position. Let warm up for about ten minutes.
3. After warm up period, adjust meter to zero by mechanically adjusting the screw in the center of the meter case.
4. Turn the range selector knob to the desired range. Connect the voltage to be measured to the terminal posts. Either positive or negative may be grounded to the common terminal. If desired, the input may be left floating above ground.
5. The voltage now indicated on the meter is accurate within 4%. It is providing typical VTVM measurements. If the meter needle swings to the left, reverse the input connections.
6. Position first two readout dials to the approximate VTVM voltage reading. Advance the null selector knob to the 1 V position. Continue to adjust the readout while increasing the null sensitivity. You are now zeroing in on the null.
7. When, by the procedure above, the null selector is at full sensitivity (1 MV) and the meter reading zero, the voltage now read from the dials is accurate to better than .01% plus 5 microvolts absolute. You may not get a reading of zero if the voltage you are measuring is not constant and fluctuating.

Operating Instructions - (Cont'd.)

READING EXCURSIONS ABOUT A NOMINAL VOLTAGE

8. To read excursions of voltage about a nominal value, set the readout dials to the nominal value. Excursions may be observed directly on the meter on any of the four null ranges. A right hand deflection of the meter indicates the voltage has increased above the nominal value by the amount indicated on the meter. For voltages read on the 10 volt range and below, use null sensitivity selector as marked. On the 100 volt ranges, the null sensitivity selector value must be multiplied by a factor of 100.

DIRECT MEASUREMENTS OF 10 VOLTS AND ABOVE

9. With the range selector in the 10 volt position, use full scale values as marked on the meter. When range selector is in the 100 volt position, multiply the meter reading by 10. On the 1000 volt range, multiply the reading by 100.

VARIATIONS IN NULL DETECTOR SENSITIVITY

9A. Due to the circuit design on the 100 volt range, the null detector will have reduced sensitivity on the 1 mv and 10 mv position. This is due to a high internal source impedance of the high voltage input divider. The sensitivity is about 50%

Operating Instructions - (Cont'd.)

less in the 1 mv null position and about 15% less on the 10 mv position. Only a very slight loss of sensitivity is noticed on the other null ranges.

When the range selector is in the 1000 volt position a 10% loss of sensitivity will be noticed in the 1 mv position. The other null ranges will have only a very slight loss of sensitivity.

MEASUREMENTS BELOW 1 VOLT IN DIFFERENTIAL MODE

10. When making measurements below 1 volt, turn Range Selector switch to the 1 volt position; set null selector to the 1 mv position; set all readout dials to zero and short positive and negative input terminals together.

11. Now set the mechanical meter adjustment to zero. This will cancel out error due to zero offset between the 1 millivolt range and the V.T.V.M. range. Remove short across terminals and proceed with the reading of voltage per paragraphs 4, 5, 6, and 7.

## Operating Instructions (Cont'd.)

### AC Mode

12. Follow instructions in the DC Mode, paragraphs 1, 2, & 3.

13. For best results connect the "GND" terminal to the "NEG" terminal although in most applications the input may be left floating.

14. When the Voltage is applied the V.T.V.M. will measure it to an accuracy of ±4%.

15. Set the first two readout dials to this approximate reading and advance the null selector to the 1 volt position. Continue to adjust the rest of the readout while increasing the null sensitivity.

16. When the null selector is at full sensitivity (10 MV) and the meter is reading zero, read the voltage from the Kelvin Varley dials to an accuracy of better than ±0.1%. You may not get a reading of zero if the voltage you are measuring is fluctuating.

17. To read excursions of voltage about a nominal value, set the readout dials to the nominal value. Excursions may be observed directly on the meter on any of the four null ranges. A right hand deflection of the meter indicates the voltage has increased above the nominal value by the amount indicated on

Operating Instructions - (Cont'd.)

AC Mode

the meter. For voltages read on the 10 volt range and below, use null sensitivity selector as marked. On the 100 volt ranges, the null sensitivity selector value must be multiplied by a factor of 100.

## CIRCUIT DESCRIPTION

### DC Section

This Calibration Standards Voltmeter is completely transistorized and designed for long trouble free life. There are no batteries or components that would normally need replacing, except the electro-mechanical chopper.

This dependable voltmeter operates on the principle of comparing an unknown voltage with an adjustable known voltage. A sensitive null detector is used to provide a means of sensing when the known and unknown voltages are equal.

This Calibration Standards voltmeter is composed of three (3) basic elements:

(1) Ultra Stable Reference Supply

(2) Accurate Kelvin Varley Divider

(3) Sensitive Null Detector

1. The heart of the voltmeter is the ultra stable reference voltage supply. This supply is a dual regulated transistor supply powering a compensated Zener reference string. The regulation for a 10% line change is better than $\pm$.001%. The temperature coefficient of the reference supply is better than .0002%/$^{o}$ C. over a temperature range of 10$^{o}$ C to 40$^{o}$ C. The supply is usable above 40$^{o}$ C with a slight derating of TC and line voltage regulation. Long term stability of the reference supply is

Circuit Description - (Cont'd.)

approximately ±.001%/year. This reference voltage supply is constructed as a plug-in module. Spares and replacements are available from the factory. When ordering be sure to indicate the serial number of the instrument.

2. The second basic element is the very accurate Kelvin Varley Divider. The first three decks are composed of 11 precision wire wound resistors per deck.

The first deck has resistors matched to ±.001% and the second and third decks have resistors matched to ±.003%. The last three readouts are accomplished with a selected precision 10 turn potentiometer. The linearity of this potentiometer is better than ±.05%. The two decks and the 10 turn potentiometer are matched together to produce an over-all divider accuracy better than ±.002% absolute. A calibration curve is provided showing the exact linearity of the Calibration Standards Kelvin Varley Readout. (See Drawing Number A-1071).

The range selector precedes the Kelvin Varley Divider. Each range has a fine adjustment potentiometer for calibration; each is calibrated separately. The 10 volt range must be calibrated first.

3. The third element is a very sensitive and stable calibrated null

Circuit Description - (Cont'd.)

detector. This null detector is used to indicate the difference between the unknown external voltage and known internal voltage. At maximum sensitivity the null detector has a full scale deflection of 1 mv. This provides ample sensitivity for accurate low level voltage measurements. The VTVM accuracy is ±4% of full scale over a temperature range of 20° C to 30° C. The instrument is usable to 40° C. but some derating should be considered.

It is not recommended that the instrument be operated above 45° C.

The null detector is capable of a long trouble free life except for the occasional replacement of the chopper. These are highly reliable, however, do occasionally need replacement. These are available from stock at the factory. The occasional calibration of the null detector may be made by adjusting the gain adjustment potentiometer at the top of the plug-in amplifier module.

The null detector is capable of large overloads without damage. On the 1 mv range a safe overload would be 50 volts short term and 10 volts long term. On the 10 mv, 100 mv, and 1 V positions, a safe overload of 500 volts is possible.

Circuit Description - (Cont'd.)

In the VTVM position ranges, safe overloads are as follows:

| | | |
|---|---|---|
| 1 | volt range: | 200 volts |
| 10 | volt range: | 250 volts |
| 100 | volt range: | 700 volts |
| 1000 | volt range: | 1500 volts |

## CIRCUIT DESCRIPTION

### AC Mode

When measuring AC voltages, an AC-DC Converter is used to convert the AC signal into a proportional DC signal over a range of 0-10 volts. Above 10 volts the AC signal is attenuated to the 0-10 volt level.

The converter, fully transistorized, has the following basic elements:

1. A precision input attenuator. (100:1 and 10:1)
2. A high gain four stage amplifier with an emitter follower output.
3. A half wave silicon diode rectifier and filter network.
4. Full wave current feedback, provided by the silicon diode network.

The closed loop gain of the amplifier is approximately 2. The open loop gain is greater than 100,000 from 30 CPS to 10 KC. The main feedback is full wave and is a function of the current through the silicon diodes. The converter measures the average value and is calibrated in RMS.

## CALIBRATION OF AC-200A

### DC Section

Diagram A 1078 in this manual shows a setup for calibrating the DC-200AR Voltmeter.

A. Calibration of the Differential Section

The "RANGE SELECTOR" - "10V" and "1V" ranges are calibrated first. On these ranges the instrument has an infinite input resistance at null.

1. Turn instrument on and let warm up for about 30 minutes.

2. Next, turn "NULL SELECTOR" to the VTVM position and zero the meter by the mechanical adjustment screw on the meter.

3. Apply a known 10-volt calibration voltage across the "POS" and "NEG" input terminals. The instrument meter should read full scale. (See Drawing Number A-1078). Turn "READOUT" dials to read 999100 and turn "NULL SELECTOR" switch to the "1 MV" position. Bring meter to zero by adjusting the appropriate calibration trim potentiometer. (See Drawing Number A-1071).

4. Repeat the basic procedure for calibration of the "1 V" range using a known 1 volt.

Calibration of AC-200A - (Cont'd.)

The "RANGE SELECTOR" - "100V" and "1000V" ranges are calibrated next. On these ranges the instrument has a 2 megohm input resistance.

5. Turn the "RANGE SELECTOR" switch to the "100V" position and apply a known 100 volt calibration voltage at meter input. Continue basic calibration procedure outlined in paragraph 3.
   NOTE: Multiply "NULL SELECTOR" ranges by 10.

6. Turn the "RANGE SELECTOR" switch to the "1000V" position. Apply a known 500 volts with the "READOUT" dials turned to 500.000. Bring meter to zero by adjusting the appropriate trim potentiometer.

B. Calibration of the VTVM Ranges

Calibrate the VTVM Ranges by setting the "RANGE SELECTOR" switch to the "10V" position and apply a known 10 volt calibration voltage. Adjust the potentiometer at the top of the amplifier plug-in module for full scale deflection. It is not necessary to calibrate the remaining VTVM ranges.

## CALIBRATION OF AC-200A/AR

### AC Section

After the DC section of the instrument has been calibrated, the AC section may be calibrated. A very stable AC source must be used along with an AC-DC transfer standard accurate to .05% or better. The Holt Model AVS-321 is recommended for the stable AC source. The setup for this calibration is shown on Drawing Number 340-111.

Calibrate the 10 volt range first. Set AC-200A to the 10 volt range with the readout at 5.0000 volts. Apply an exact 5 volts at 400 CPS. Adjust amplifier gain control located at the top of the converter plug-in module using the 10 mv null range sensitivity. Now change the frequency of the AC source to 10,000 CPS and adjust the trim capacitor located at the top of the converter module. Turn the instrument range selector to the 100 volt range and set the readout at 50.000 volts. Apply 50 volts 400 CPS to the meter and adjust the 100 volt calibration trimpot located on the back of the main calibration board.

Change the frequency to 10,000 CPS and adjust the 100 volt trim capacitor on the calibration board. Change the frequency to 5 KC, and adjust the 100 volt trimpot on the front of the main calibration board. 10 KC and 5 KC may have to be adjusted a few times to insure best calibration. Turn the instrument range selector to the 1000 volt range and set the readout to 500.00 volts. Apply 500 volts 400 CPS to the meter and adjust the 1000 volt calibration trimpot located on the main calibration board. Change the frequency to 10,000 CPS and adjust the 1000 volt trim capacitor, also located on the main calibration board. Change the frequency to 5 KC and adjust the 100 volt trimpot on the front of the main calibration board. Readjust 10 KC and 5 KC if necessary. This now completes the calibration of the complete instrument.

## WARRANTY

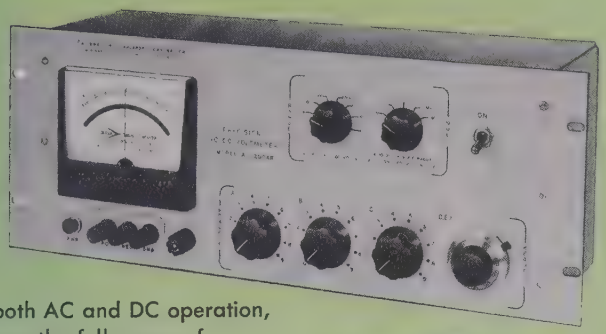
The CALIBRATION STANDARDS CORPORATION warrants each instrument to be free from defects in material and workmanship. Material not covered by this warranty are fuses and choppers. The instrument must be returned to the factory with shipping prepaid and a complete report of the difficulty. This warranty is good for one year from the shipping date.

## SHIPPING DAMAGE

If there is any damage to the instrument upon receipt, report this to the transportation Claim Agent immediately.

# CONTINUOUSLY SELF-CALIBRATING

Model AC-200AR

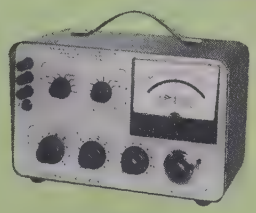


6-Digit Readout, both AC and DC operation, for all readings over the full range of 0 to 1,000 Volts.

Incorporates ultra-stable Zener references (±2PPM/°C, ±0.001% for 10% line voltage change. Long Term Stability—0.001%/yr)

Ranges: .05V to 1000V AC, 0V to 1000V DC.

Most Sensitive Null Range: ±1 mv for AC and DC.



Model AC-200A

a c d

## PRECISION VOLTMETER

**0.1%** AC Accuracy*

**0.01%** DC Accuracy*

**±0.001%** Stability for ±10% line voltage change.

±2PPM per °C Temp. Stability

*Accuracies are of reading, not full scale.

All transistorized, Model AC-200A and AC-200AR AC-DC Precision Voltmeters offer users the ultimate in stability and reliability for both laboratory and production line applications. They operate within guaranteed specifications over an ambient temperature range of +10°C to +40°C. Both rack and cabinet models incorporate recorder and reference output terminals to facilitate continuous chart type recording.

Utilizing all of the advantages of semi-conductor circuitry, CSC's completely solid state, Precision AC-DC Voltmeters are small, portable and lightweight. They incorporate extremely stable Zener references (0.001%/yr) and precision wire-wound resistors (0.001%/yr) that are carefully selected and aged to further guarantee accuracy and long term stability.

The continuously self-calibrating feature (60 times per second) that is built into these instruments removes the inherent error due to recalibration. Also, it obsoletes the time consuming operation of recalibration each time the instruments are turned on, moved from one location to another or during long term measurements. The Stability of the Null Amplifier eliminates the need for Zero Controls. Long term evaluation tests by government and industrial users have proved these instruments to be more accurate and stable than indicated by the conservative specifications.

**CALIBRATION STANDARDS CORPORATION**

A subsidiary of ROYAL INDUSTRIES, INC.

1031 WESTMINSTER AVE.
ALHAMBRA, CALIFORNIA
CUMBERLAND 3-8156

# PRECISION VOLTMETER

## SPECIFICATIONS

DC 0-1v, 0-10v, 0-100v, 0-1000v.
AC 0-10v, 0-100v, 0-1000v.
AC & DC ±1mv, ±10mv, ±100mv, ±1 volt, full scale. (x 10 on 100 volt range and x 100 on 1000 volt range.)
DC ±0.01% + 5 microvolts absolute from 0-1000 VDC.
AC ±0.1% absolute from .5 volts to 1000 volts, 50 cps to 5 KC. ±0.15% absolute from .05 volts to 1000 volts, 30 cps to 10 KC. Reduced accuracy below .5 volts.
AC & DC ±4%.
DC Infinite at null, 0 to 10 volts. 2 megohms above 10 volts.
AC 1megohm +25 pf on 10 and 100 volt ranges. 2 megohms +25 pf on 1000 volt range.
±0.001% for a ±10% line change.
±2PPM/°C over an ambient temperature range of +10°C to +40°C.
105-125 VAC, 50-60 cps at 8 watts.
Cabinet 12" w., 7½" h., 6½" d.
Rack 19" w., 7½" h., 6½" d.
14 lbs.
Cabinet $1425.00.
Rack $1445.00.

Model AC-200A and Model AC-200AR AC-DC Precision Voltmeters are compact, potentiometric instruments designed to measure both AC and DC voltages to a high degree of accuracy. The operation of the instruments is the same for both AC and DC measurements. By using a multiturn potentiometer at the end of the Kelvin-Varley divider, a very high resolution can be obtained. The instruments incorporate a 6-digit readout with the last 3 digits on a precision 10 turn potentiometer.

Calibration Standards designs and manufactures Precision Electronic Test Instrumentation for Industry including... All transistorized 0-1000 VDC Voltmeters that combine extremely wide measurement ranges with absolute accuracies to ±0.01% + 5 microvolts and Stability of ±0.001%; AC Precision Voltmeters with a range of 0-1000 volts, absolute Accuracy of ±0.005% + 5 microvolts DC and ±0.1% AC; Combination Precision Voltmeter and Power Supply with a range from 0 to 1000 volts, absolute Accuracy of 0.01% + 5 microvolts as a Voltmeter or 0.01% + 50 microvolts as a Power Supply; Combination Volt-Amp meters with absolute Accuracy of ±0.05% + 5 microvolts from 0 to 1000 VDC and ±0.1% from 1 microampere to 1 ampere; Unique, ultra-sensitive Galvanometer, Power Supply and Wheatstone Bridge in a single package; Voltage Regulation Monitors to measure voltage stability and to final check DC regulated power supplies, and Primary Voltage References with Guaranteed Stability of 2PPM/3 months, 3PPM/year and Accuracy of 0.0015%.

CALIBRATION STANDARDS CORPORATION

# CALIBRATION DATA

SALE ORDER NO. _____

DATE 17 Nov 62

MODEL AC 200 AR

SERIAL NO. 1323

| RANGE | D.C. ACCURACY |
|---|---|
| 1000 V | 0011 07 |
| 100-V | 0011 |
| 10-V | 0002 |
| 1-V | 0011 16 |
| .1-V | |

REFERENCE

TEMP. COEFFICIENT < 2 PPM/°C %

VOLTAGE 16

## AMPLIFIER

NOISE 1/5 DIV.

ZERO OFFSET 1/5 DIV.

VTVM 2 %

NULL SENSITIVITY

SCALE 10 V RANGE

1-V < 2 07

.1V < 2

10-MV < 2

1-MV < 2 0

REMARKS _____

L Campbell

TEST TECHNICIAN

# CALIBRATION DATA

SALE ORDER NO. _____

DATE 17 NOV. 1962

MODEL AC-200AR

SERIAL NO. 1323

| RANGE | FREQUENCY | |
|---|---|---|
| 1000 V | 400 CPS | ±.02 % |
| | 10 KC | ±.02 % |
| 100 V | 400 CPS | −.02 % |
| | 10 KC | −.03 % |
| 10 V | 400 CPS | ±.01 % |
| | 10 KC | −.01 % |

VOLTAGE LINEARITY, FREQ. 1 KC

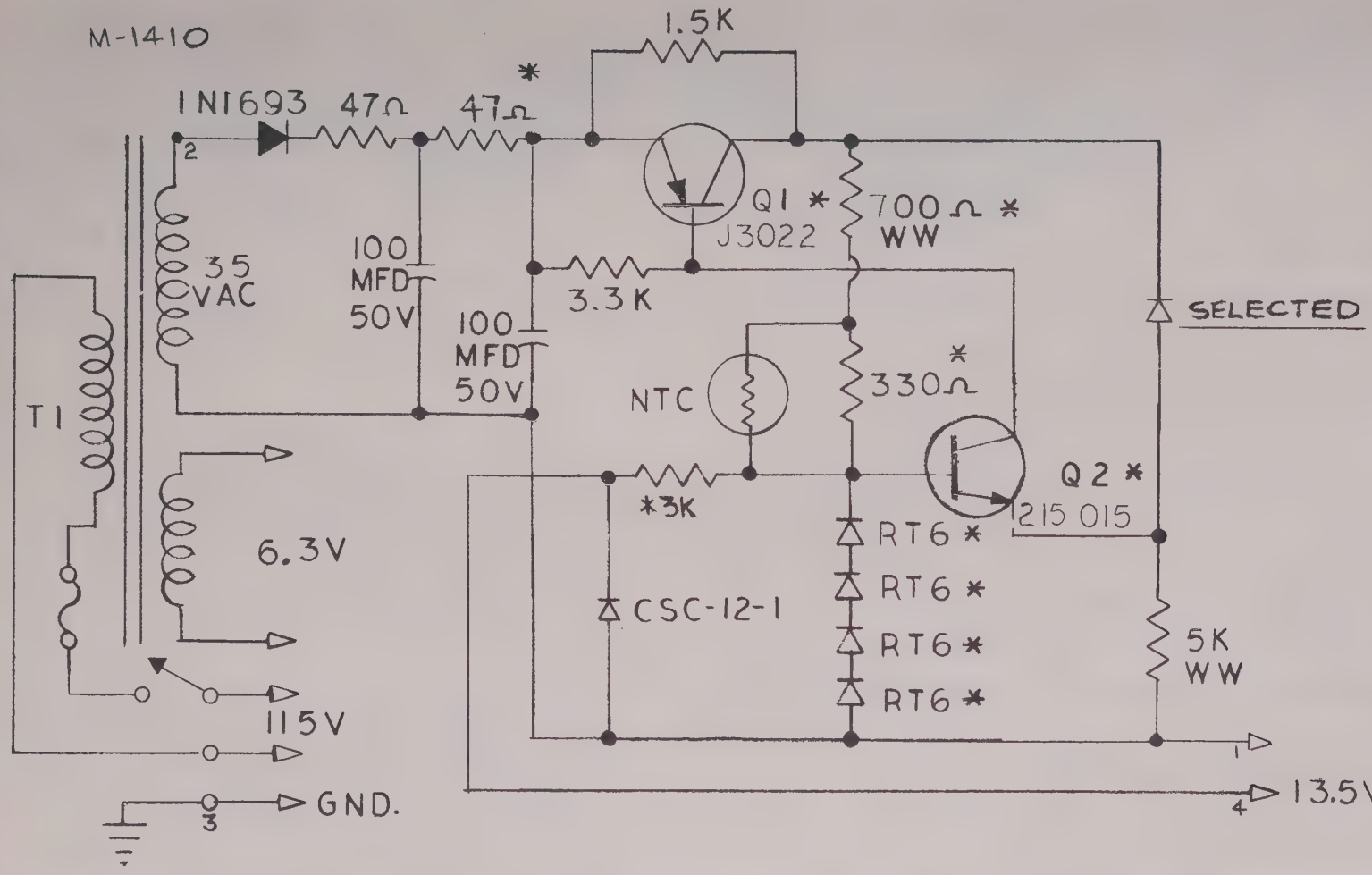
.05 %

REMARKS _____

TEST TECHNICIAN

DWG. NO. 340-018 | ISSUE E | THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALIBRATION STANDARDS CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR MANUFACTURE OR SALE OF APPARATUS OR DEVICES WITHOUT PERMISSION.

| CHANGE | DATE | ISSUE | BY | APP. |
|---|---|---|---|---|
| A REVISED & REDRAWN | 5-2-9 | A | WJF | W.J.F. |




* FACTORY SELECTED

| DET. | MATERIAL | QTY. |
|---|---|---|
| | | |

TOLERANCES: EXCEPT AS SHOWN:
FRACTION ±
DECIMAL ±
ANGLES ±

DATE: 12-7-60
DWN: WJF
CHKD:
APPD:
SCALE:

**CALIBRATION STANDARDS CORPORATION**
ALHAMBRA — CALIFORNIA

TITLE: 13.5-V REF. SUPPLY, SCHEMATIC

NEXT ASSEMBLY.
USED ON:

DRAWING NO. 340-018 ISSUE E

DWG. NO. 340-027 | ISSUE A | THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALIBRATION STANDARDS CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR MANUFACTURE OR SALE OF APPARATUS OR DEVICES WITHOUT PERMISSION.

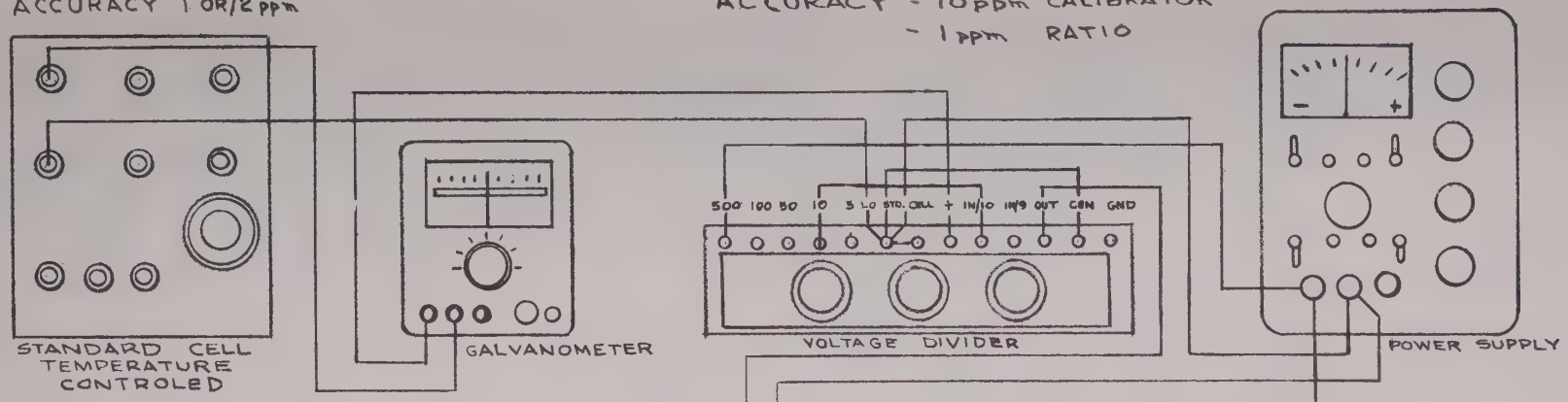
| CHANGE | DATE | ISSUE | BY | APP. |
|---|---|---|---|---|
| | | | | |

JULIE RESEARCH LABS
MODEL 500-106
ACCURACY 1 OR/2 ppm

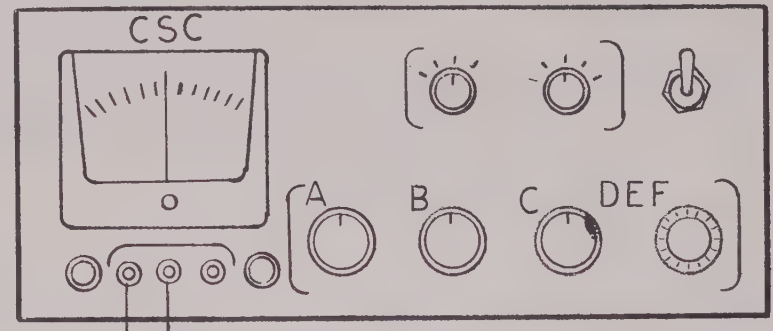
HP425AR

JULIE RESEARCH LABS
MODEL VRS-105/6
ACCURACY - 10ppm CALIBRATOR
- 1ppm RATIO

KIN TEL
MODEL 301


500 100 50 10 5 1.0 STD. CELL + IN/10 IN/9 OUT COM GND
STANDARD CELL TEMPERATURE CONTROLED
GALVANOMETER
VOLTAGE DIVIDER
POWER SUPPLY

CSC MODEL DC-200AR OR/ RV-200AR




| SETTINGS | VRS-105 | RATIO | 301 |
|---|---|---|---|
| 500V | 500V | NOT USED | 500V |
| 100V | 100V | NOT USED | 100V |
| 10V | 10V | NOT USED | 10V |
| 1V | 5V | .2V | 5V |

NOTE: THE TWO LEFT HAND DIALS ON THE VRS-105/6 ARE USED TO DIAL OUT THE CORRECT STANDARD CELL VOLTAGE. THE REMANING DIAL IS FOR RATIO VOLTAGES

1VOLT WHEN VRS-105/6 IS SET FOR 5VOLTS AND RATIO SIDE IS SET FOR 10:1

| DET. | MATERIAL | QTY. |
|---|---|---|
| | | |

TOLERANCES: EXCEPT AS SHOWN:
FRACTION ±
DECIMAL ±
ANGLES ±

DATE: 12-26-60
DWN: WJF
CHKD: EJ
APPD:
SCALE:

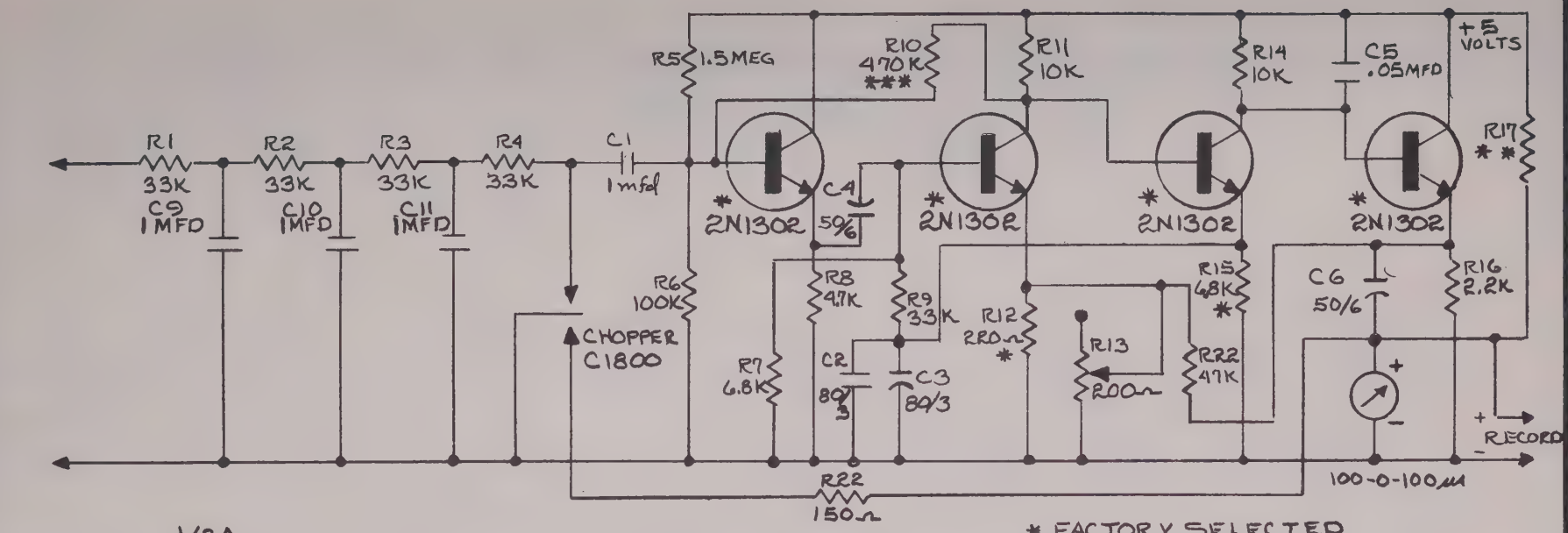
**CALIBRATION STANDARDS CORPORATION**
ALHAMBRA — CALIFORNIA

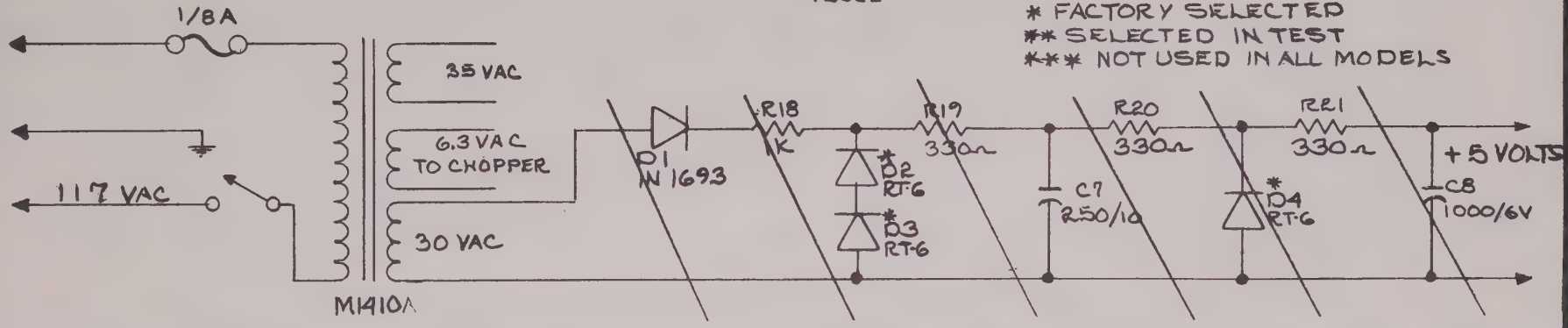
TITLE: AC/DC/RV-200AR, CALIBRATION —

NEXT ASSEMBLY:
USED ON:

DRAWING NO. 340-027
ISSUE A

| DWG. NO. | ISSUE | | CHANGE | DATE | ISSUE | BY | APP. |
|---|---|---|---|---|---|---|---|
| 340-038 | J | THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALIBRATION STANDARDS CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR MANUFACTURE OR SALE OF APPARATUS OR DEVICES WITHOUT PERMISSION. | | | | | |




* FACTORY SELECTED
** SELECTED IN TEST
*** NOT USED IN ALL MODELS

| DET. | MATERIAL | QTY. |
|---|---|---|
| | | |

TOLERANCES: EXCEPT AS SHOWN:
FRACTION ±
DECIMAL ±
ANGLES ±

DATE: 1-30-62
DWN: W M & CURDY
CHKD:
APPD:
SCALE:

**CALIBRATION STANDARDS CORPORATION**
POMONA — CALIFORNIA

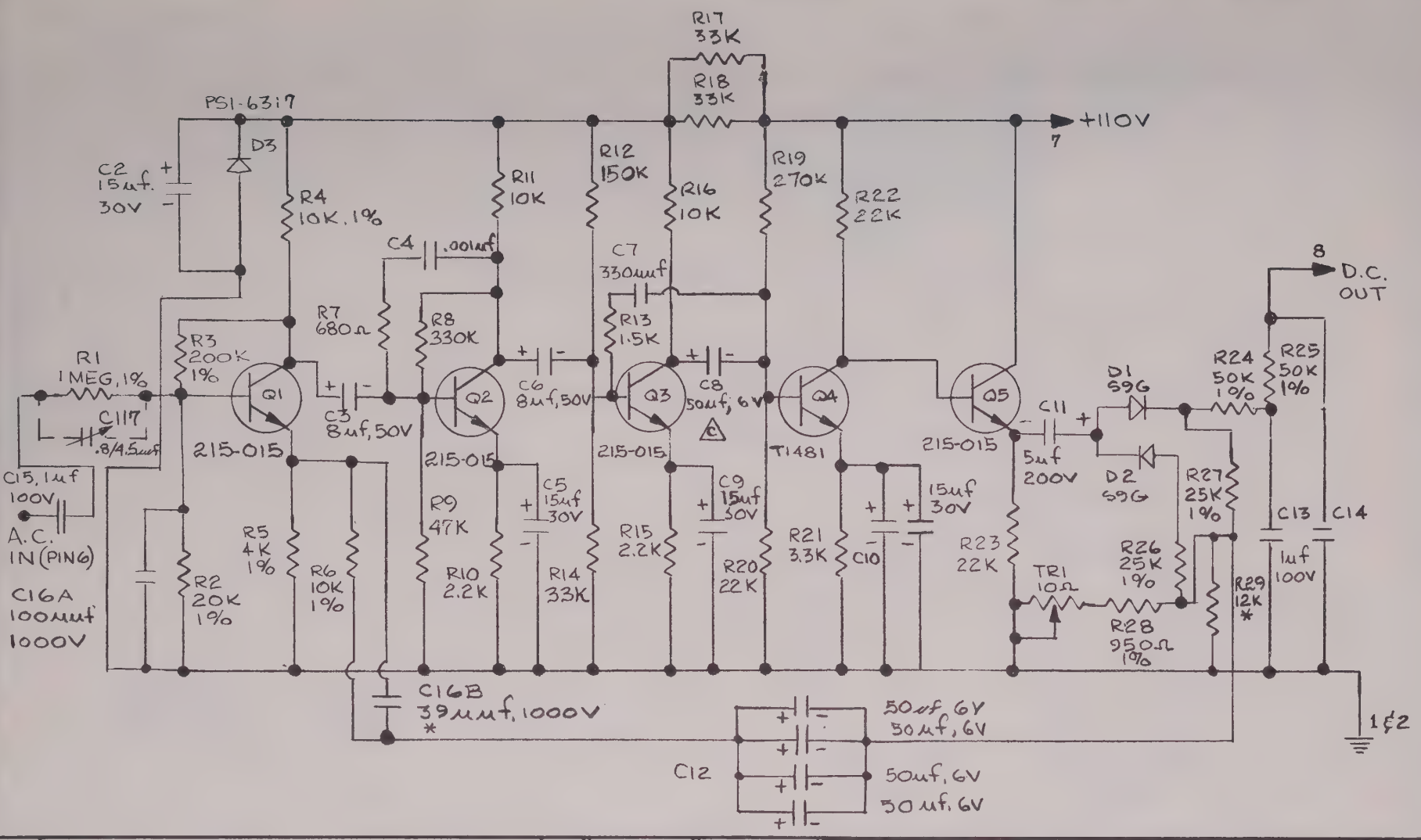
TITLE: A, R-SCHEMATIC, AMPLIFIER

NEXT ASSEMBLY:
USED ON: ALL INSTRUMENTS

DRAWING NO. 340-038 ISSUE J

| DWG. NO. | ISSUE | |
|---|---|---|
| 340-050 | G | THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALIBRATION STANDARDS CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR MANUFACTURE OR SALE OF APPARATUS OR DEVICES WITHOUT PERMISSION. |

| CHANGE | DATE | ISSUE | BY | APP. |
|---|---|---|---|---|
| | | | | |




| DET. | MATERIAL | QTY. |
|---|---|---|
| | | |

| TOLERANCES: EXCEPT AS SHOWN: | DATE: |
|---|---|
| FRACTION ± | DWN: |
| DECIMAL ± | CHKD: |
| ANGLES ± | APPD: |
| | SCALE: |

**CALIBRATION STANDARDS CORPORATION**
ALHAMBRA — CALIFORNIA

TITLE: CONVERTER AMPLIFIER

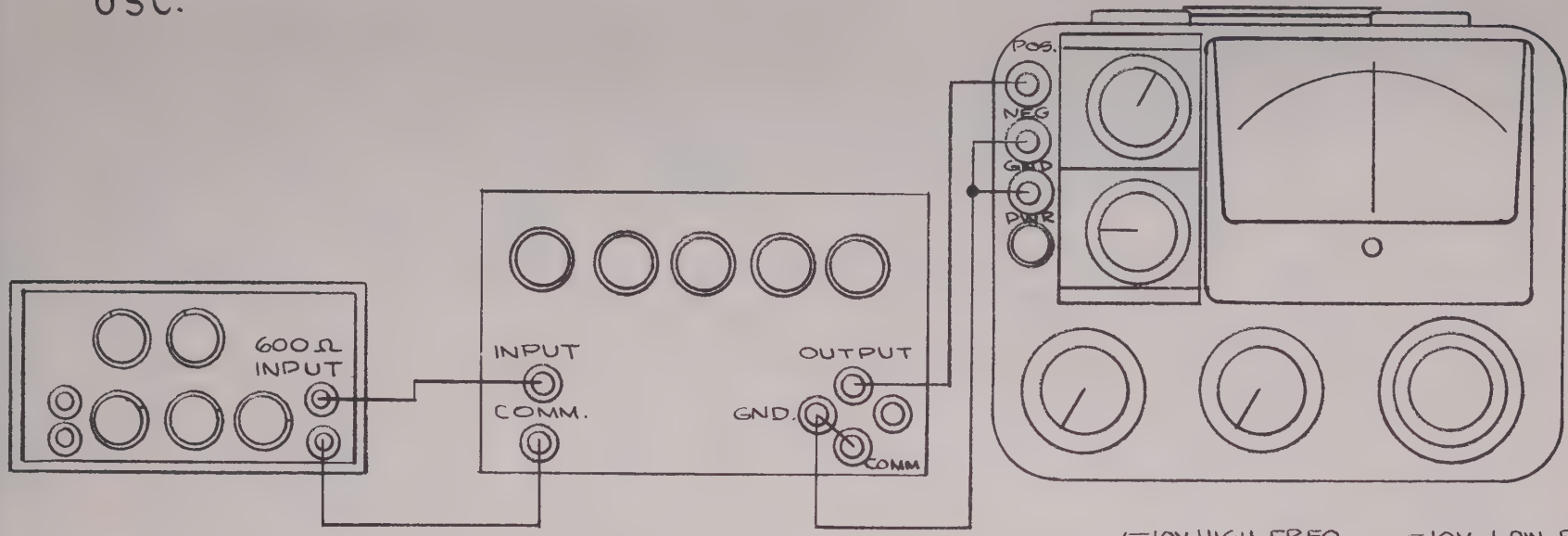
NEXT ASSEMBLY:
USED ON:

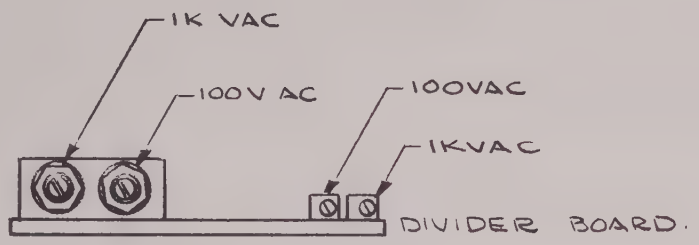
| DRAWING NO. | ISSUE |
|---|---|
| 340-050 | G |

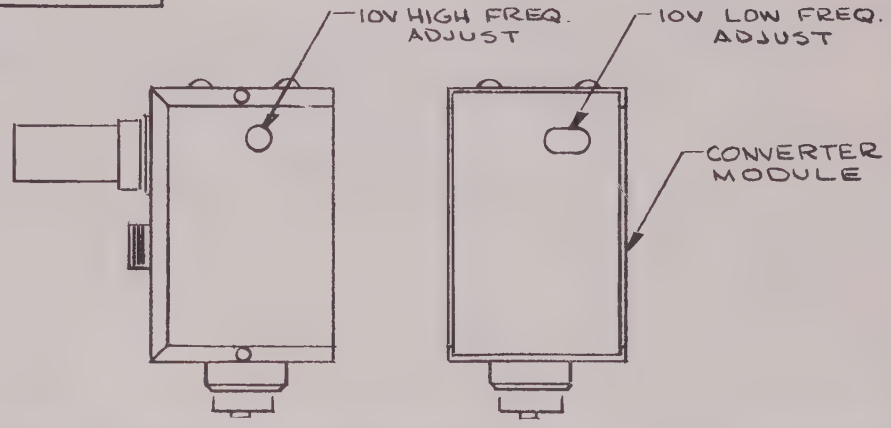
| DWG. NO. | ISSUE | |
|---|---|---|
| 340-061 | A | THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALIBRATION STANDARDS CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR MANUFACTURE OR SALE OF APPARATUS OR DEVICES WITHOUT PERMISSION. |

| CHANGE | DATE | ISSUE | BY | APP. |
|---|---|---|---|---|
| | | | | |

# PRECISION OSC. A-C/VOLTAGE SOURCE (AC-100, 200 SERIES)




| DET. | MATERIAL | QTY. |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

| TOLERANCES: EXCEPT AS SHOWN: | DATE: 6-4-62 |
|---|---|
| FRACTION ± | DWN: W J F |
| DECIMAL ± | CHKD: |
| ANGLES ± | APPD: |
| | SCALE: |

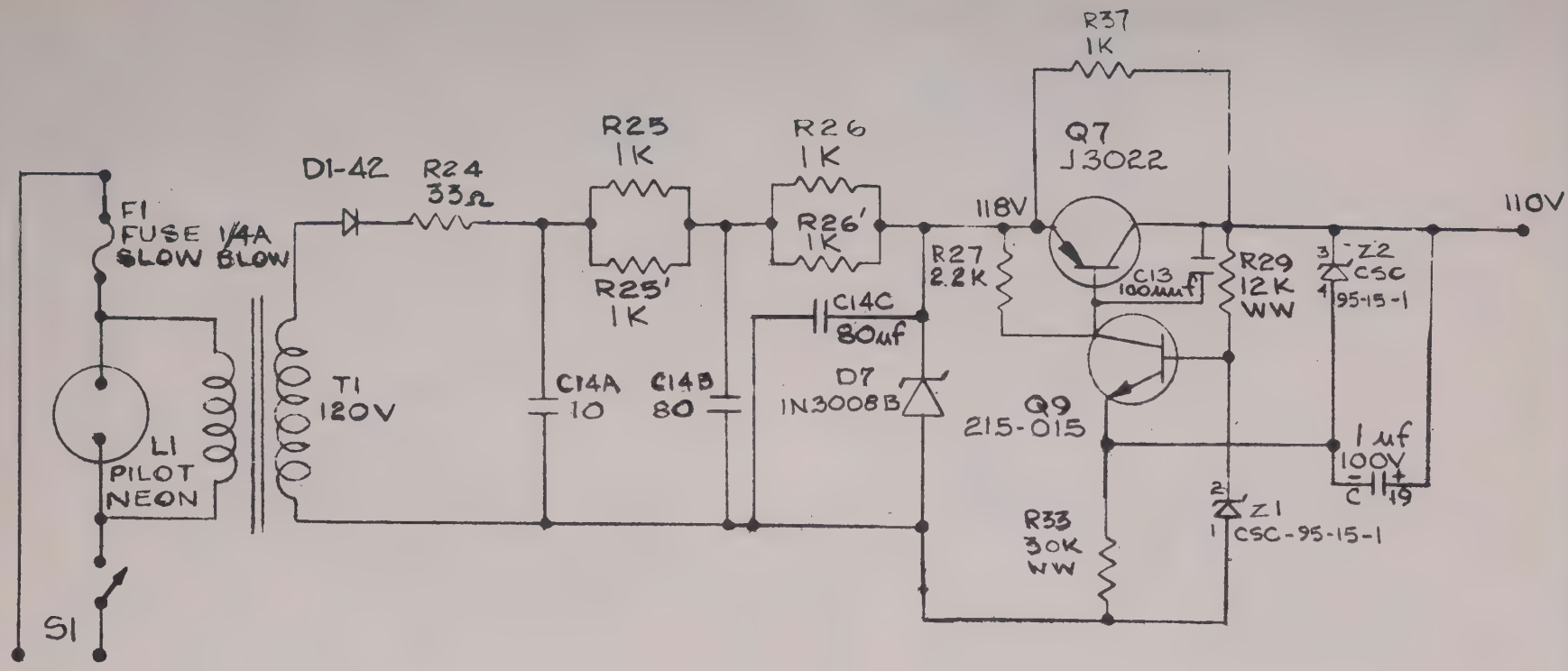
**CALIBRATION STANDARDS CORPORATION**
ALHAMBRA — CALIFORNIA

TITLE: AC-CALIBRATION SETUP

| NEXT ASSEMBLY: | DRAWING NO. | ISSUE |
|---|---|---|
| USED ON: | 340-061 | A |

| DWG. NO. | SHEET | CHANGE | DATE | ISSUE | BY | APP. |
|---|---|---|---|---|---|---|
| 340-069 | D | | | | | |

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALIBRATION STANDARDS CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR MANUFACTURE OR SALE OF APPARATUS OR DEVICES WITHOUT PERMISSION.



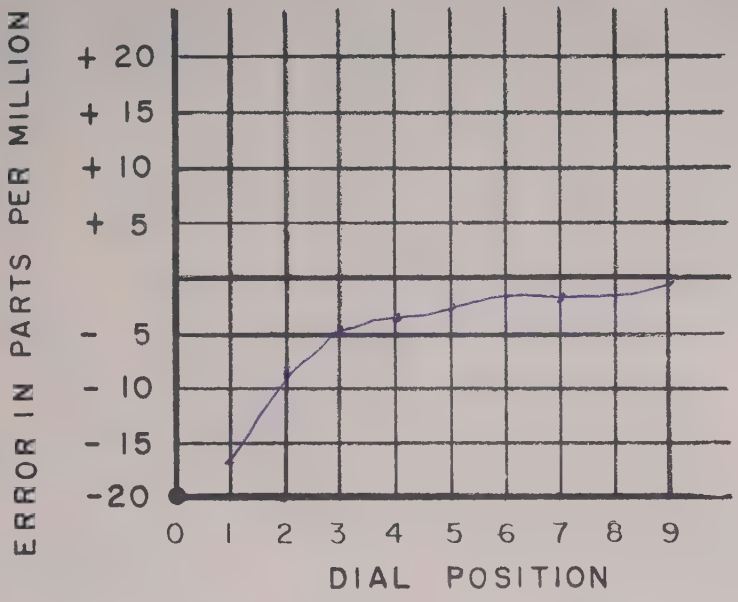

| | | | | | |
|---|---|---|---|---|---|
| | C-100A/AR, AC-200A/AR | | TOLERANCES EXCEPT AS SHOWN: | DATE: 10-28-60 | CALIBRATION STANDARDS CORPORATION |
| | | | FRACTION ± | DWN: WJF | POMONA — CALIFORNIA |
| | ALL RESISTORS, 1/2W, ±10%, CARBON | | DECIMAL ± | CHKD: | PWR. SUPPLY SCHEM. |
| | (*) FACTORY SELECTED | | ANGLES ± | APPD: | NEXT ASSEMBLY: |
| DET. | MATERIAL | QTY. | | SCALE: | USED ON: |

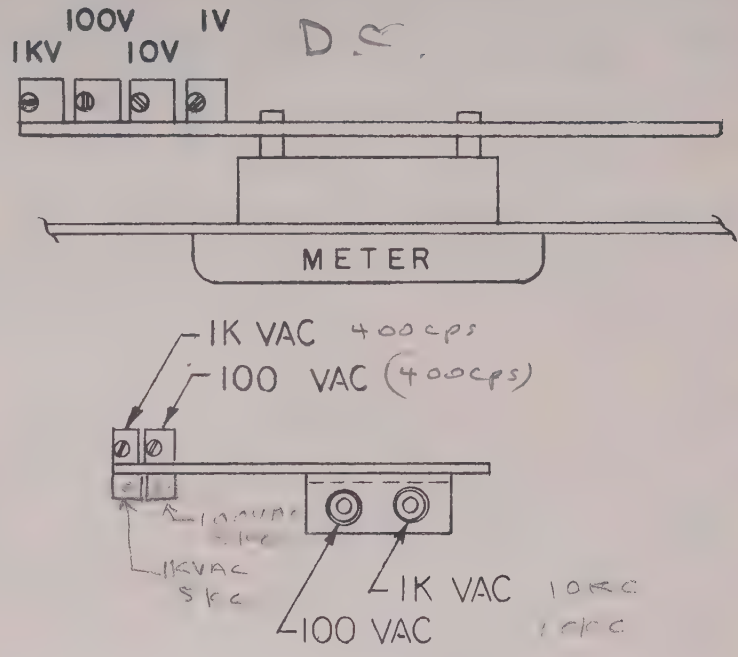
DRAWING NO. 340-069 ISSUE D

DWG. NO. 340-078 | ISSUE N/C | THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALIBRATION STANDARDS CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR MANUFACTURE OR SALE OF APPARATUS OR DEVICES WITHOUT PERMISSION.

| CHANGE | DATE | ISSUE | BY | APP. |
|---|---|---|---|---|
| | | | | |

## CALIBRATION ADJUSTMENTS




KELVIN VARLEY DIVIDER CALIBRATION
CHECKED AGAINST OUR 1 PPM MASTER DIVIDER

INSTRUMENT SERIAL# 1323

| DET. | MATERIAL | QTY. | TOLERANCES: EXCEPT AS SHOWN: FRACTION ± DECIMAL ± ANGLES ± | DATE: 12-19-60 DWN: W J F CHKD: APPD: SCALE: |
|---|---|---|---|---|

CALIBRATION STANDARDS CORPORATION
POMONA — CALIFORNIA

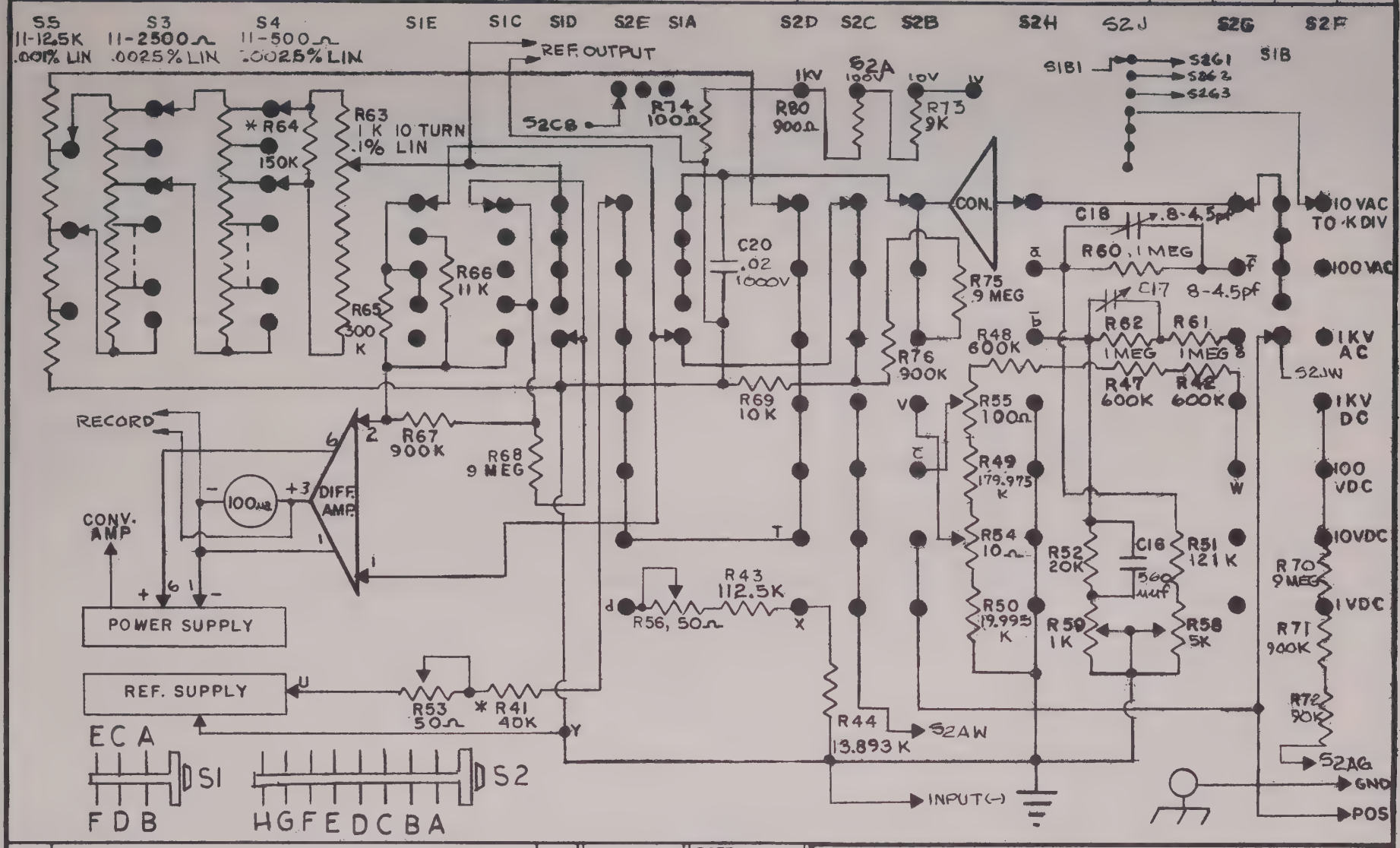
TITLE: AC200-AR, CALIBRATION CHART

NEXT ASSEMBLY:
USED ON:

DRAWING NO. 340-078 ISSUE N/C

| DWG. NO. | ISSUE | |
|---|---|---|
| 340-080 | D | THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALIBRATION STANDARDS CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR MANUFACTURE OR SALE OF APPARATUS OR DEVICES WITHOUT PERMISSION. |

| CHANGE | DATE | ISSUE | BY | APP. |
|---|---|---|---|---|
| | | | | |




| DET. | MATERIAL | QTY. |
|---|---|---|
| | (*) FACTORY SELECTED | |

| TOLERANCES: EXCEPT AS SHOWN: | DATE: 11,1,60 |
|---|---|
| FRACTION ± | DWN: WJF |
| DECIMAL ± | CHKD: |
| ANGLES ± | APPD: |
| | SCALE: |

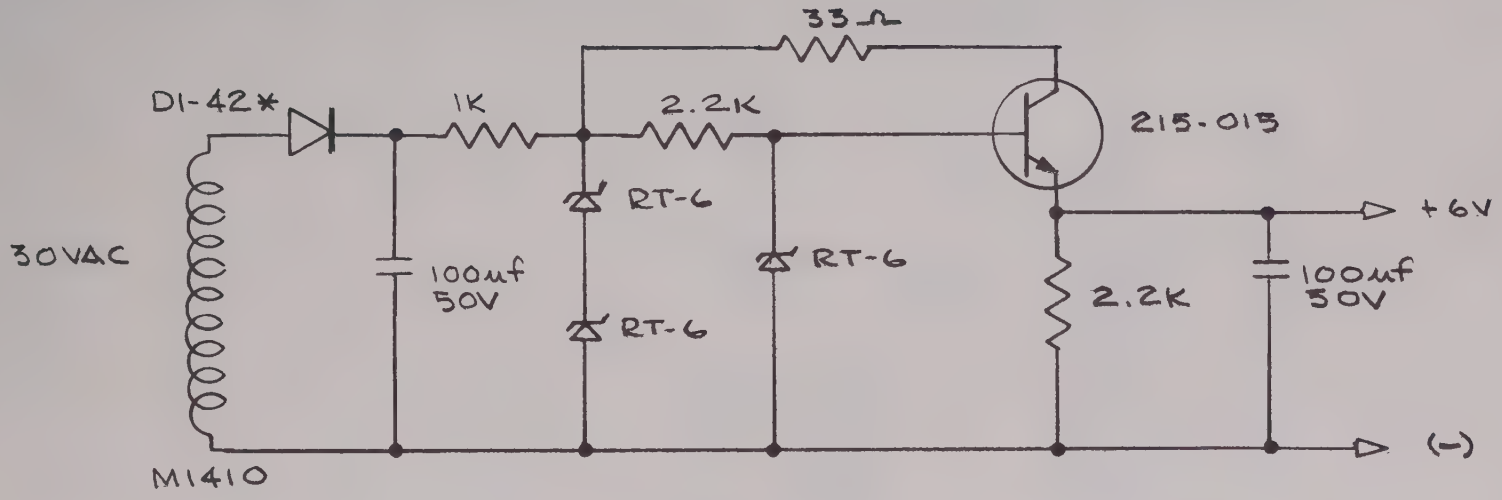
**CALIBRATION STANDARDS CORPORATION**
POMONA — CALIFORNIA

TITLE.
# AC-200A/AR BASIC SCHEMATIC

| NEXT ASSEMBLY: | DRAWING NO. | ISSUE |
|---|---|---|
| USED ON: | 340-080 | D |

| DWG. NO. | ISSUE | |
|---|---|---|
| 340-094 | NC | THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALIBRATION STANDARDS CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR MANUFACTURE OR SALE OF APPARATUS OR DEVICES WITHOUT PERMISSION. |

| CHANGE | DATE | ISSUE | BY | APP. |
|---|---|---|---|---|
| | | | | |




* SELECTED

| DET. | MATERIAL | QTY. |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

| | |
|---|---|
| TOLERANCES: EXCEPT AS SHOWN: | |
| FRACTION ± | |
| DECIMAL ± | |
| ANGLES ± | |
| DATE: | 4-2-62 |
| DWN: | WJF |
| CHKD: | |
| APPD: | |
| SCALE: | — |

**CALIBRATION STANDARDS CORPORATION**
POMONA — CALIFORNIA

TITLE: SCHEM., D.C. PWR/S

NEXT ASSEMBLY:
USED ON: D.C. INSTRUMENTS

DRAWING NO. 340-094 ISSUE N/C

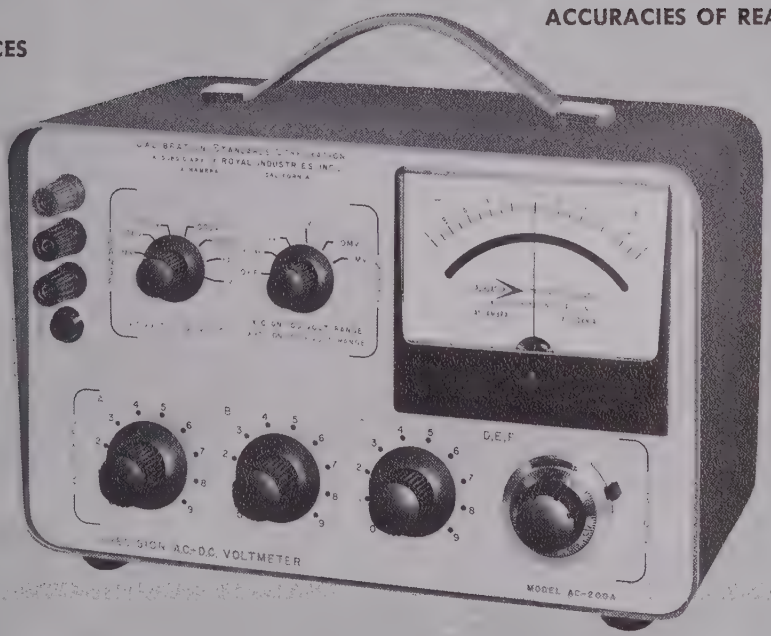
# PRECISION VOLTMETER

## SHORT CATALOG

CONTINUOUSLY SELF-CALIBRATING

ACCURACIES OF READING, NOT FULL SCALE

ULTRA-STABLE ZENER REFERENCES




5 & 6 DIGIT READOUTS

NO ZERO CONTROLS

ALL TRANSISTORIZED

RACK AND CABINET MODELS

LIGHTWEIGHT

PLUG-IN MODULES

LOW POWER CONSUMPTION

0—1000 VDC
.05—1000 VAC

ULTRA-STABLE KELVIN-VARLEY DIVIDER

±1 MILLIVOLT NULL SENSITIVITY

COMPACT, PORTABLE

CALIBRATED BY PRIMARY STANDARDS

INFINITE INPUT IMPEDANCE

PRECISION, AGED RESISTORS

**CALIBRATION STANDARDS CORPORATION**

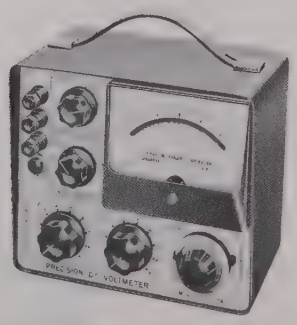
# ALL CALIBRATION STANDARDS PRECISION VOLTMETERS

INCORPORATE THESE OUTSTANDING

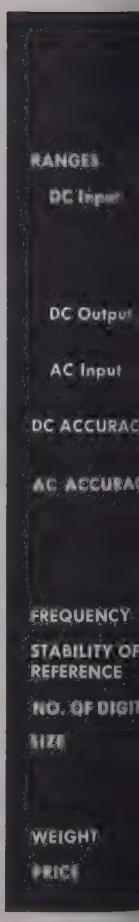
# FEATURES

- Continuously Self-Calibrating (60 times per second)
- Ultra-Stable Zener References (Series 200 Instruments, 0.001%/year, 0.001% for 10% line change, 2PPM/°C; Series 100 Instruments, 0.01%/year, 0.005% for 10% line change, 5PPM/°C; Series 110 Instruments, 0.005%/year, 0.005% for 10% line change, 3PPM/°C)
- Precision selected and aged wire-wound resistors with stability of 0.001%/year (Series 200) and 0.005%/year (Series 100 )
- No Zero Controls necessary
- No Calibration Controls necessary
- Lightweight, Compact, Portable
- All Transistorized
- Low Power consumption
- All Accuracies stated are of reading, not full scale
- Measurement Ranges of 0 to 1000 volts DC and .05 to 1000 volts AC
- 6 digit readout for Series 200 Instruments, 5 digit readout for Series 100 Instruments
- Most sensitive Null range is ±1 millivolt for AC and DC measurements
- All instruments calibrated by Primary Standards with traceability to the Bureau of Standards
- Certificates supplied upon request
- All instruments available in cabinet and rack models
- Recorder output to facilitate long term strip chart recording
- Operation is the same for both AC and DC measurements
- Ultra-Stable Kelvin-Varley Divider
- Infinite Input Impedance
- Differential Input
- Plug-in Modules

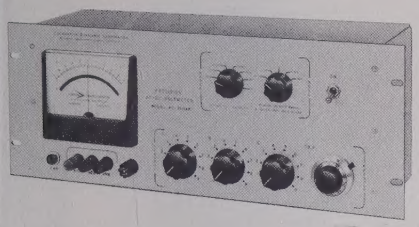
DC VOLTMETER MODEL DC-200A



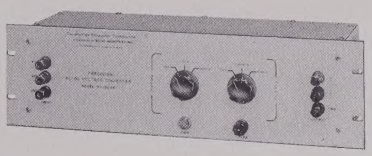
DC VOLTMETER MODEL DC-110A



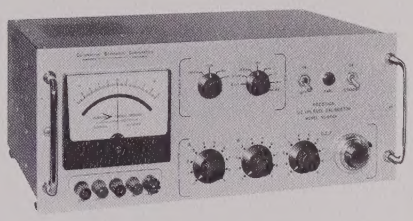
# PRECISION ELECTRONIC INSTRUMENTS FOR INDUSTRY



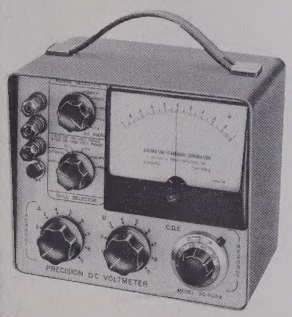
AC/DC VOLTMETER MODEL AC-200AR



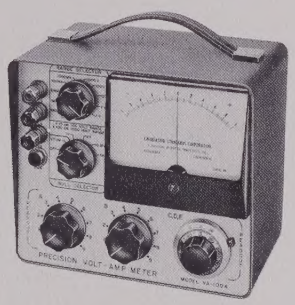
AC/DC CONVERTER MODEL C-100AR



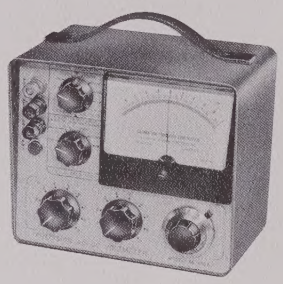
DC VOLTAGE CALIBRATOR MODEL VC-200A



DC VOLTMETER MODEL DC-100A



DC VOLT-AMP METER MODEL VA-100A



AC/DC VOLTMETER MODEL AC-100A

| AC-200A AC-200AR | DC-200A DC-200AR | AC-100A AC-100AR | DC-100A DC-100AR | DC-110A DC-110AR | VA-100A VA-100AR | VC-200A VC-200AR | C-100A C-100AR | C-200A C-200AR |
|---|---|---|---|---|---|---|---|---|
| 0-1v, 10v, 100v, 1000v | 0-1v, 10v, 100v, 1000v | 0-.1v, 1v, 10v, 100v, 1000v | 0-.1v, 1v, 10v, 100v, 1000v | 0-.1v, 1v, 10v, 100v, 1000v | 0-.1v, 1v, 10v, 100v, 1000v 0-.01 ma, .1 ma, 1 ma, 10 ma, 100 ma, 1 amp | 0-1v, 10v, 100v, 1000v | | |
| 0-10v, 100v, 1000v | | 0-10v, 100v, 1000v | | | | 0-1v, 10v, 100v, 1000v | 0-10v 0-10v, 100v, 1000v | 0-10v 0-10v, 100v, 1000v |
| 0.01% +5 $\mu$v | 0.01% +5 $\mu$v | 0.05% +5 $\mu$v | 0.05% +5 $\mu$v | 0.025% +5 $\mu$v | 0.05% +5 $\mu$v 0.1% +.001 $\mu$a | 0.01% +5 $\mu$v | | |
| 0.15% 30 CPS–50 CPS 0.1% 50 CPS–5 KC 0.15% 5 KC–10 KC | | 0.2% | | | | | 0.15% | 0.15% 30 CPS–50 CPS 0.1% 50 CPS–10 KC 0.15% 10 KC–20 KC |
| 30 CPS–10 KC | | 30 CPS–10 KC | | | | | 30 CPS–10 KC | 30 CPS–20 KC |
| 0.001% per yr. | 0.001% per yr. | 0.01% per yr. | 0.01% per yr. | 0.005% per yr. | 0.01% per yr. | 0.001% per yr. | 0.05% per 30 days | 0.025% per 30 days |
| 6 | 6 | 5 | 5 | 5 | 5 | 6* | | |
| A–12"w. x 7"h. x 6"d. AR–19"w. x 7"h. x 6"d. | A–12"w. x 7"h. x 6"d. AR–19"w. x 7"h. x 6"d. | A–8"w. x 7"h. x 6"d. AR–19"w. x 7"h. x 6"d. | A–8"w. x 7"h. x 6"d. AR–19"w. x 7"h. x 6"d. | A–8"w. x 7"h. x 6"d. AR–19"w. x 7"h. x 6"d. | A–8"w. x 7"h. x 6"d. AR–19"w. x 7"h. x 6"d. | A–17"w. x 7"h. x 12"d. AR–19"w. x 7"h. x 12"d. | A–8"w. x 7"h. x 6"d. AR–19"w. x 5¼"h. x 6"d. | A–8"w. x 7"h. x 6"d. AR–19"w. x 3½"h. x 6"d. |
| 14 lbs. | 12 lbs. | 11 lbs. | 9 lbs. | 9 lbs. | 7 lbs. | 25 lbs. | 7 lbs. | 7 lbs. |
| A –$1425.00 AR–$1445.00 | A –$965.00 AR–$985.00 | A –$855.00 AR–$875.00 | A –$475.00 AR–$495.00 | A –$550.00 AR–$570.00 | A –$625.00 AR–$645.00 | A –$1440.00 AR–$1440.00 | A –$535.00 AR–$555.00 | A –$825.00 AR–$845.00 |

*6 Digit Readout As Voltmeter, 6 Digit Dialout As Power Supply.

## COMBINATION GALVANOMETER, POWER SUPPLY AND WHEATSTONE BRIDGE MODELS WB-100A and WB-110A

CSC's unique 3 in 1 combination offers users an unusually accurate, ultra-sensitive Wheatstone Bridge, all transistorized chopper readout amplifier and a bridge voltage power supply in a single, compact, lightweight and portable instrument for laboratory and production line test. Priced below competitive instruments, both the Model WB-100A and WB-110A provide High Resolution and a 5 digit readout over the full range. The instruments can be used as resistance comparators. They are available in both cabinet and rack mount.

**ACCURACY:**
WB-100A: ±0.05% + .005 ohm absolute.
WB-110A: ±0.025% + .003 ohm absolute.
**RANGE:** 1 ohm to 100 ohms in 8 ranges.
**SENSITIVITY:** 1 mv for full scale.
**READOUT:** 5 digits.
**INPUT VOLTAGE:** 117 VAC, 50-60 cps.
**WEIGHT:** 8 lbs.
**SIZE:**
WB-100A & WB-110A: 8"w., 7"h., 6"d.
WB-100AR & WB-110AR: 19"w., 7"h., 6"d.
**PRICE:**
WB-100A: $575.00.
WB-100AR: $595.00.
WB-110A: $685.00.
WB-110AR: $705.00.

## REGULATION MONITORS MODELS RM-2A, RM-2A-3, RM-2A-5

Designed specifically to measure the stability of any DC voltage from 2.0 volts to 500 volts, CSC's three Regulation Monitors read out directly in percent deviation. Drift is less than 0.005% for an 8 hour day and short term drift is less than 0.002%. At maximum sensitivity, the meter shows a full scale deflection for a deviation of ±0.1%. Fully transistorized for stable, reliable operation, the instruments incorporate ultra-stable Zener References and precision, aged wire-wound resistors. Sensitivity Range is ±0.001% to ±10% in 3 ranges, ±.1% F.S., ±1% F.S., and ±10% F.S. Major applications include check out of regulated DC power supplies, drift measurement of equipment during environmental test and design, performance and drift measurement of such components as zener diodes, transistors, gas filled regulators, batteries and resistors and in repair and calibration laboratories to trouble shoot drift problems in electronic instruments and systems.

**TEMPERATURE STABILITY:** ±0.0005% /°C from 10-40°C.
**SENSITIVITY:** .1%, 1%, 10% full scale.
**VOLTAGE RANGE:**
RM-2A: 2-500 VDC.
RM-2A-3: 2-3000 VDC.
RM-2A-5: 2-5000 VDC.
**CALIBRATION ACCURACY:** ±5% of reading + one small scale division on all ranges.
**SMALLEST READABLE DEVIATION:** 0.001%.
**INPUT RESISTANCE:** 7000 ohms per volt or greater.

| | | |
|---|---|---|
| | 15 volt range | 100K |
| | 50 volt range | 350K |
| RM-2A: | 150 volt range | 1.1 meg. |
| | 500 volt range | 3.5 meg. |
| RM-2A-3: | 3000 volt range | 21.0 meg. |
| RM-2A-5: | 5000 volt range | 35.0 meg. |

**STABILITY:** Less than 0.005% change from 100 to 130 VAC.
**WEIGHT:**
RM-2A: 7 lbs.
RM-2A-3: 8 lbs.
RM-2A-5: 8 lbs.
**SIZE:**
RM-2A, RM-2A-3 & RM-2A-5: 8"w., 7"h., 6"d.
RM-2AR, RM-2AR-3 & RM-2AR-5: 19"w., 7"h., 6"d.
**PRICE:**
RM-2A: $390.00.
RM-2AR: $410.00.
RM-2A-3: $485.00.
RM-2AR-3: $505.00.
RM-2A-5: $595.00.
RM-2AR-5: $615.00.

Calibration Standards Corporation designs and manufactures Self-Calibrating, Transistorized Precision Electronic Instruments for Industry including . . .

AC and DC Precision Voltmeters that combine extremely wide measurement ranges with Accuracies of ±0.1% absolute (.5-1000 VAC), ±0.01% + 5 microvolts absolute (0-1000 VDC) and Stability of ±0.005%/yr.

Dual Purpose Voltage Calibrators that provide 0-1000 VDC as a Power Supply and measure 0-1000 VDC with Accuracies of ±0.01% and Stability of ±0.005%/yr.

Combination Volt-Amp meters accurate to ±0.05% (0-1000 volts) and ±0.1% (0-1 amp).

Unique, ultra-sensitive Galvanometer, Power Supply and Wheatstone Bridge in a single package.

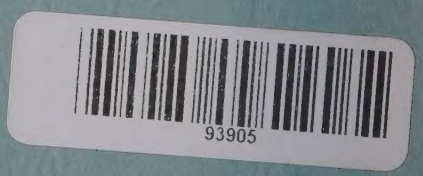
Voltage Regulation Monitors to measure voltage stability and to final check DC regulated power supplies.

Primary Voltage References with Guaranteed Stability of 2PPM/3 months, 3PPM/yr. and Accuracy of ±0.0015%.

All Accuracies are of reading, not full scale.

**CALIBRATION > STANDARDS CORPORATION**

A subsidiary of ROYAL INDUSTRIES, INC.
1031 Westminster Avenue
Alhambra, California




CALIBRATION STANDARDS CORPORATION *a subsidiary of* **ROYAL INDUSTRIES, INC.**

CS-295-001

PRINTED IN U.S.A.